PEACE/WILLISTON
FISH & WILDLIFE
COMPENSATION
PROGRAM

BC hydro

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COLUMBIA

Kelly Lake System and Cameron Lakes System Beaver Dam Assessment

Diversified Environmental Services
1992

PWFWCP Report No. 267

The Peace/Williston Fish & Wildlife Compensation Program is a cooperative venture of BC Hydro and the provincial fish and wildlife management agencies, supported by funding from BC Hydro. The Program was established to enhance and protect fish and wildlife resources affected by the construction of the W.A.C. Bennett and Peace Canyon dams on the Peace River, and the subsequent creation of the Williston and Dinosaur Reservoirs.

Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave. 3rd Floor, Prince George B.C. V2L 3H9

Website: *www.bchydro.bc.ca/environment/initiatives/pwcp/*

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Author(s): Diversified Environmental Services[1]
Address(es): [1] PO Box 6263
Fort St. John, B.C.
V1J 4H7

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Prepared for:

B.C. Environment
Fort St. John, B.C.

Prepared by:

Diversified Environmental Services
PO Box 6263
Fort St. John, B.C.
V1J4H7

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1.0 INTRODUCTION

The Kelly Lake Metis community and the West Moberly Indian Band have independently approached the B.C. Ministry of Environment, Lands and Parks with concerns about beaver activity on streams effecting their respective communities.

The community of Kelly Lake is located 60 kilometres south of Dawson Creek, on the north shore of Kelly Lake (Fig. 1) . The settlement is skirted by a stream which empties into Kelly Lake. The source of this stream is comprised of a series of headwater lakes linked by segments of creek.

The West Moberly Indian Reserve is located on the west end of Moberly Lake (Fig. 2). Cameron Creek, which drains North and South Cameron Lakes, empties into Moberly Lake on IR 168, not far from the West Moberly native settlement.

In both project areas, anecdotal evidence suggests that fish may have used these streams as migration routes to additional spawning and rearing habitat. Both communities have identified beaver activity as the cause of decreasing flow rates, decreases in water quality, and loss of fish habitat and migration routes.

The purpose of this assessment is to investigate the nature and extent of this problem, identify stream clearance options, and assess the impacts of dam removal on the levels of the headwater lakes.

2.0 METHODS

Five sections of stream within the two project areas were investigated. These consisted of: 1) the stream between Kelly and Gauthier Lake, 2) the stream between Gauthier and Foster Lake, 3) the stream between Foster and Lower Twin lake, 4) Cameron Creek between Moberly Lake and South Cameron Lake, and 5) Cameron Creek between South Cameron Lake and North Cameron Lake. A sixth section, that between Lower and Upper Twin Lakes was originally included but beaver activity at the outlet of the lower lake over the last decade has raised water levels, joining the two lakes and eliminating the section of stream between them. There is no beaver activity in the narrows between the two lakes.

Data concerning the number, size and location of all beaver dams within the five stream sections were collected during helicopter overflights of the two project areas on November 8th and 9th 1992.

Two flights were made on each section of stream, travelling from the mouth to the source. The first pass was a higher altitude reconnaissance flight during which general stream characteristics were observed and recorded on a vertical mounted VHS video camera and on 35mm print film.

The second pass was flown at lower altitude in an effort to collect information on specific in-stream obstructions. The entire length of each section was again recorded on vertical mounted VHS video and representative sections were recorded on 35mm print film. In addition, a Global Positioning System (GPS) computerized receiver was used to record the exact configuration of each length of stream. Beaver dams and other relevant features on the channels were assigned event markers and were electronically keyed onto the GPS data file as they were encountered.

Ground work was undertaken at the head of each section of stream. A series of water depths were taken at the outlet of each of the headwater lakes so that outlet profiles could be plotted to determine the impacts of stream clearance on lake levels.

Upon completion of the field work, a basic map of each section was generated from the GPS computer file. Electronic events markers appearing on the map were matched and cross-referenced with individual beaver dams and other features on the video and 35mm photographs. In this way, general annotation was added and the boundaries of individual beaver dam reservoirs were digitized onto the map file. Each beaver dam was given a dam number and classified according to its height (small-under 50 cm, medium-50 to 130 cm and large-over 130 cm). Dam numbers were recorded on the final map version, labelled onto 35mm plates and dubbed onto the edited video track.

Options for beaver dam removal were investigated and an estimate of the cost of stream clearance on each section was developed.

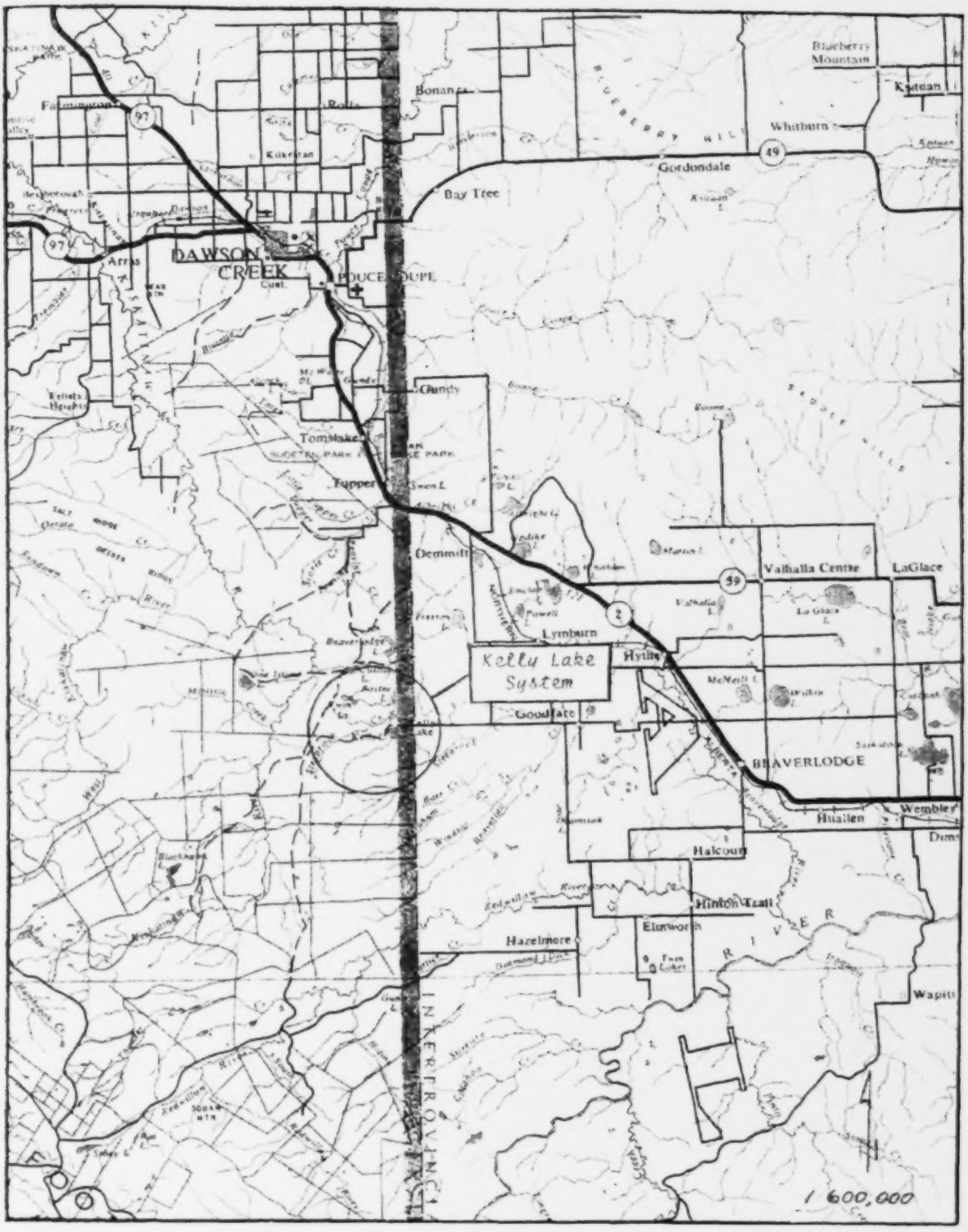


Figure 1: Location of the Kelly Lake system - 1:600,000.

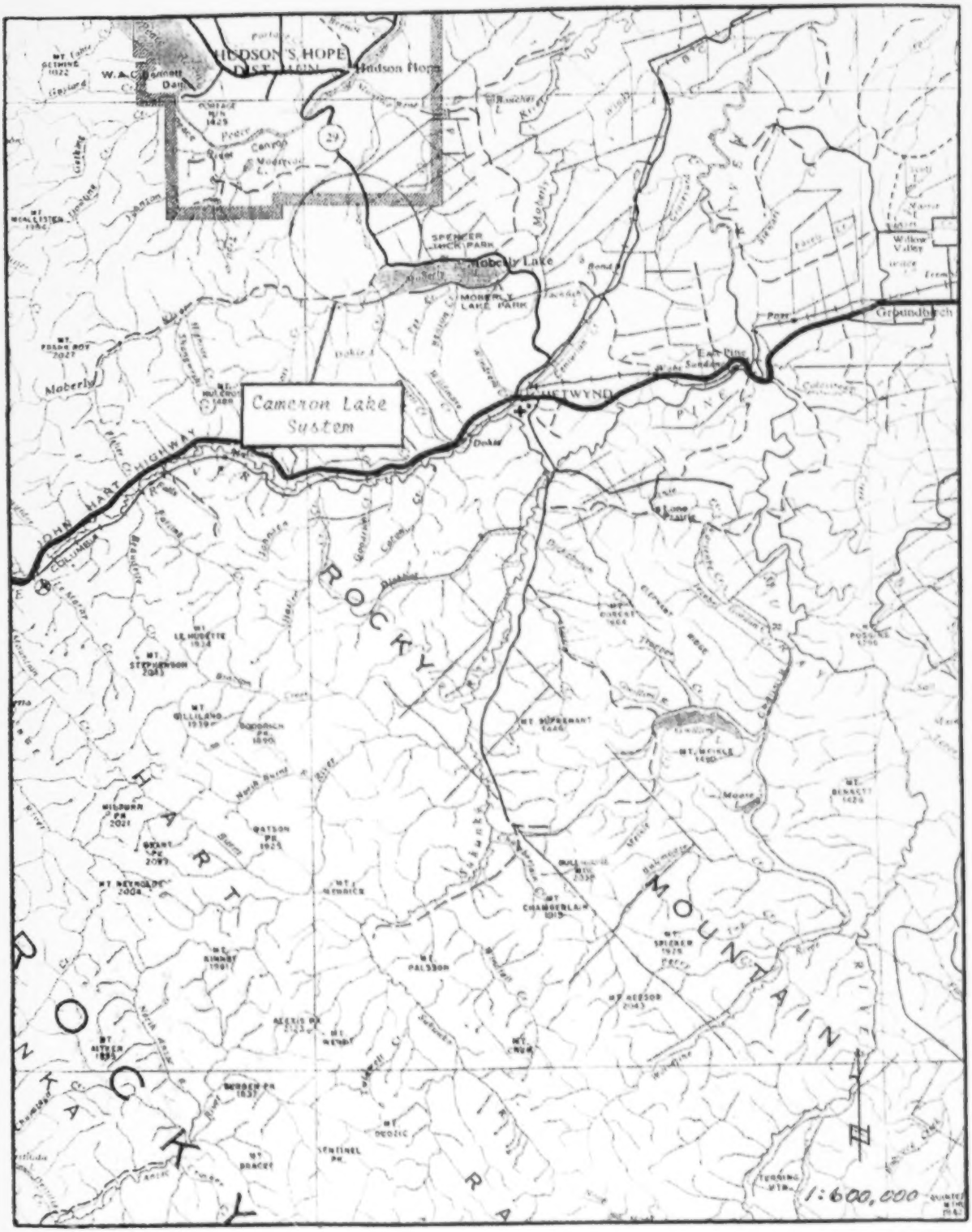


Figure 2: Location of the Cameron Lakes system - 1:600,000.

3.0 RESULTS AMD DISCUSSION

Summarized results appear in Table 1. Each stream section is then discussed separately.

	SEC 1	SEC 2	SEC 3	SEC 4	SEC 5
HEADWATER LAKE	Gauthier	Foster	L. Twin	S. Cam	N. Cam
SECT LENGTH (KM)	1.75	1.75	5.40	2.55	1.40
NO. OF DAMS	4	2	36	21	13
DAM HEIGHT S/M/L	1/1/2	0/0/2	16/14/6	12/6/3	7/4/2
IMPACT ON LAKE LEVEL	100 cm	40 cm	70 cm	105 cm	100 cm

Table 1: Data summary for the five stream sections in both project areas.

3.1 KELLY LAKE SYSTEM

The Kelly Lake project area consists of a series of small, shallow lakes. Kelly Lake, itself, supports a population of northern pike. Gauthier, Foster and Twin Lakes have the potential to provide spawning and rearing habitat on a seasonal basis, but have been cut off from the Kelly Lake pike population by extensive beaver activity.

A review of aerial photographs taken in 1956 shows that beaver activity in the system, since that time, has brought about significant change. The photos reveal that 1956 lake levels were considerably lower than today's. The area between Upper and Lower Twin Lakes was a short stream instead of the present narrowing of the lakes. Much of the area currently covered by swamp, marsh and open water was sedge meadow and riparian willow before the influx of beaver activity.

The apparent absence of beaver activity 20 to 30 years ago lends support to the theory that Gauthier and Foster Lakes were historically utilized as fish habitat.

3.1.1 Stream Section 1 - Kelly Lake to Gauthier Lake

Section 1 skirts the community of Kelly Lake before entering Kelly Lake itself. All four dams on this section are found on the lower 25% (Appendix 1). The uppermost dam (D4L), which is located adjacent to the settlement, is the largest and maintains a significant reservoir which extends up through the remaining 75% of the stream and into Gauthier Lake. Residents have expressed some concern about the proximity of this encroaching beaver dam reservoir to three adjacent sewer lagoons.

Dam 4 (L) currently maintains Gauthier Lake at approximately one metre above its "normal" level.

All four dams on this section are easily accessible by road.

3.1.2 Stream Section 2 - Gauthier Lake to Foster Lake

Only two dams exist on Section 2; both are large (Appendix 2). In the middle section between the two dams there are three makeshift road-crossings. The lower crossing consists of a small log bridge and a culvert. If water levels drop as a result of beaver dam removal, this crossing may have to modified to allow for fish passage. The middle and upper road-crossings will both constitute impasses to fish movement. The middle crossing consists of a deck of logs pushed into the stream and covered with fill, while the upper crossing consists only of fill pushed into the stream. The stream presently flows across the top of this crossing.

The upper beaver dam on this section (D6L) maintains Foster lake at approximately 40 centimetres above its "pre-beaver" level.

All portions of this section can be accessed by road except for the marshy area immediately upstream of Gauthier Lake.

3.1.3 Stream Section 3 - Foster Lake to Twin Lakes

Stream section 3 is more than three times the length of Sections 1 or 2 and contains 36 beaver dams (D9S to D42L) (Appendix 3). In addition to several significant marsh areas, beavers have created two wide expanses of open water in the middle portions of the section (D32L and D36M).

Dam number 42 is the uppermost obstruction. It maintains Lower Twin Lake at approximately 70 centimetres above its normal level and has eliminated the short section of stream which historically existed between Upper and Lower Twin Lakes.

Although no road access exists on this section, cat trails, ATV trails and a pipeline ROW provide ATV access to within walking distance of most areas. Some sections of trail have been flooded by beaver activity.

3.2 CAMERON LAKES SYSTEM

The Cameron Lakes project area consists of two segments of stream: Section 4 (Moberly Lake to South Cameron Lake) and Section 5 (South Cameron Lake to North Cameron Lake). The lower third of Section 4 lies within the boundaries of the West Moberly Indian Reserve 168A.

Beaver activity in the outlets of North and South Cameron Lakes appears to date back many years, although aerial photographs taken earlier than 1981 were not available. Headwater lake levels have not changed significantly in the last ten years and have probably been maintained above normal levels for the past several decades. Beaver activity in the lower and middle portions of both sections, however, has increased considerably since 1981.

3.2.1 Stream Section 4 - Moberly Lake to South Cameron Lake

Section 4 is the longer of the two Cameron sections and contains twenty-one beaver dams (Appendix 4). The first two dams on this section (D1M & D2L) are relatively recent structures and have created an extensive area of stagnant water below and above the West Moberly access road.

The upper half of Section 4 (D12S through D21S) has been modified by a series of old, low dams. Over a period of many years, the channel in this area has become a long marsh approximately 80 metres wide and 1000 metres in length. Eutrophication has made the original stream channel unrecognizable in some portions.

The upper three dams of this section (D19 to D21) are currently holding the level of South Cameron Lake at 1.05 metres above its "pre-beaver" level.

The lower portion of this section is accessible by way of the West Moberly access road while the remainder is accessible only by walking from Highway 29, which runs parallel to the stream.

3.2.2 stream Section 5 - South Cameron Lake to North Cameron Lake

Section 5 is the shortest of the five stream sections and contains thirteen beaver dams (Appendix 5). Dam 22, at the lower end of the section is typical of the old, low type and has created a extensive marsh area over the years. Several dams in the middle portion are more recent and reservoirs here are deeper and narrower where stream banks confine and channel.

The upper three dams on this section (D32 to D34) maintain North Cameron Lake at approximately 1.0 metres above its normal level.

Access to the beaver dams on Section 5 can be gained by a short walk from Highway 29, which parallels the stream.

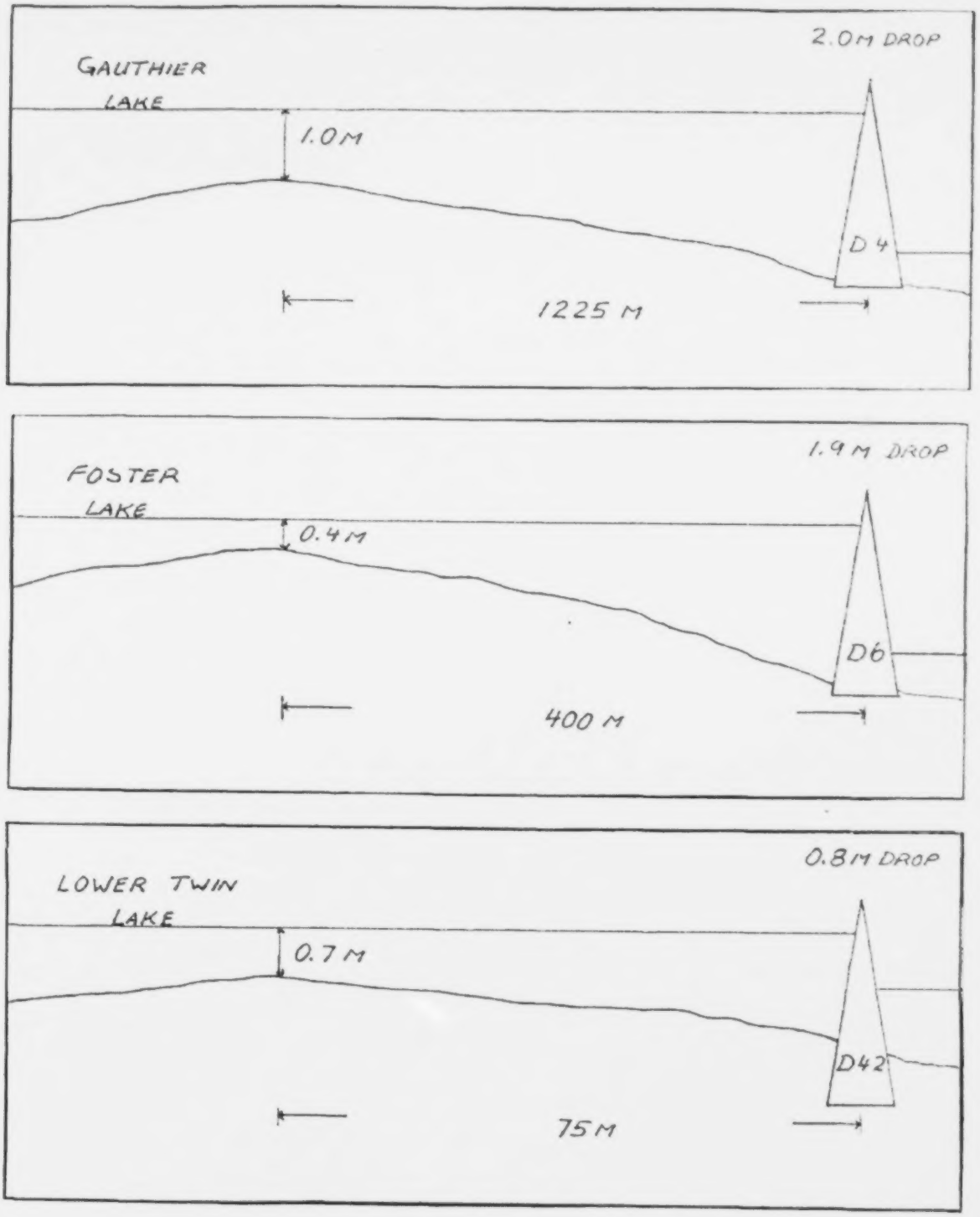


Figure 3: Profiles of the Kelly Lake system outlets.

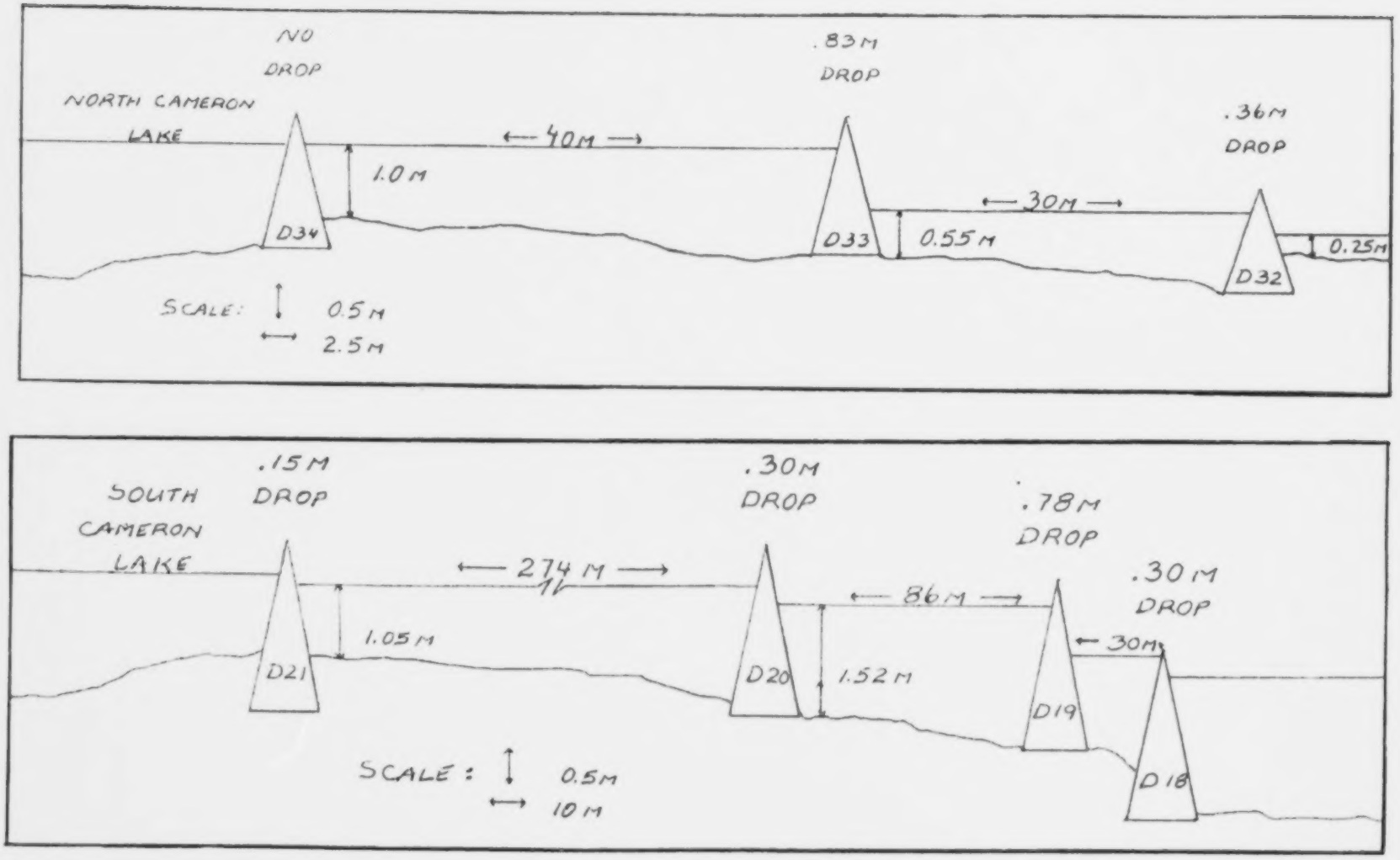


Figure 4: Profiles of the Cameron Lakes system outlets.

4.0 STREAM CLEARANCE OPTIONS AND COSTS

Two beaver dam removal techniques were investigated. The first involved the use of a small excavating machine and the second involved the use of explosives.

4.1 Option 1: Machines

A rubber tire backhoe (Case 580 equivalent) or small bulldozer with backhoe attachment (Cat D3 equivalent) are suitable pieces of machinery for the removal of beaver dams. Machines such as this, however, have limitations in areas of poor access or wet ground. A limited number of beaver dams might be accessed by machines during the summer. More could be accessed after fall freeze-up but access to some would still pose major logistical problems.

Damage to stream banks and riparian areas would be unavoidable in some cases and would vary greatly according to moisture conditions, channel configuration and vegetative type.

Where access allows the use of machinery, a better job can be made of channel re-construction at dam sites where the restoration of fish passage is the objective.

4.2 option 2: Explosives

The use of explosives for the removal of beaver dams has obvious advantages where vehicle access is a problem. Explosives can be transported to inaccessible dam sites by ATV or by foot during summer conditions. Damage to stream banks and riparian areas is normally non-existent. Removed material and debris can usually be scattered sparsely over a wider area and rendered unavailable for immediate dam reconstruction. Special considerations for safety would have to be made in areas such as Stream Section 1 where inhabited residences are in close proximity.

Beaver dam removal by explosives may necessitate the use of additional labour where fish passage is the ultimate objective. Hand and shovel work may be required for dam site clean-up and limited channel re-construction where the scouring action of reservoir release isn't sufficient to restore an even-gradient channel.

4.3 Budget Estimates

Upon reviewing the issues of access, riparian damage and cost, it was decided that the use of explosives should be favoured over the use of machines.

The following are cost estimates for the removal of beaver dams from the five stream sections investigated. These do not include the removal of fish impasses caused by manmade obstructions or channel eutrophication. Estimates include 1) organization and supervision from a fisheries perspective, 2) certified blaster and explosives, and 3) labour as required for site and channel clean-up.

SECTION 1	
Supervision	
one day	250.00
travel	160.00
Blaster	
four dams	250.00
travel	160.00
Labour	
two man/days	300.00
	$ 1,120.00

SECTION 2	
Supervision	
one day	250.00
travel	160.00
Blaster	
two dams	200.00
travel	160.00
Labour	
one man/day	150.00
	$ 920.00

SECTION 3	
Supervision	
six days	1500.00
travel & accom	660.00
ATV	450.00
Blaster	
36 dams	1850.00
travel & accom	560.00
ATV	375.00
Labour	
ten man/days	1500.00
	$ 6,895.00

SECTION 4

Supervision	
four days	1000.00
travel & accom	400.00
Blaster	
21 dams	1050.00
travel & accom	400.00
Labour	
eight man/days	1200.00
	$ 4,050.00

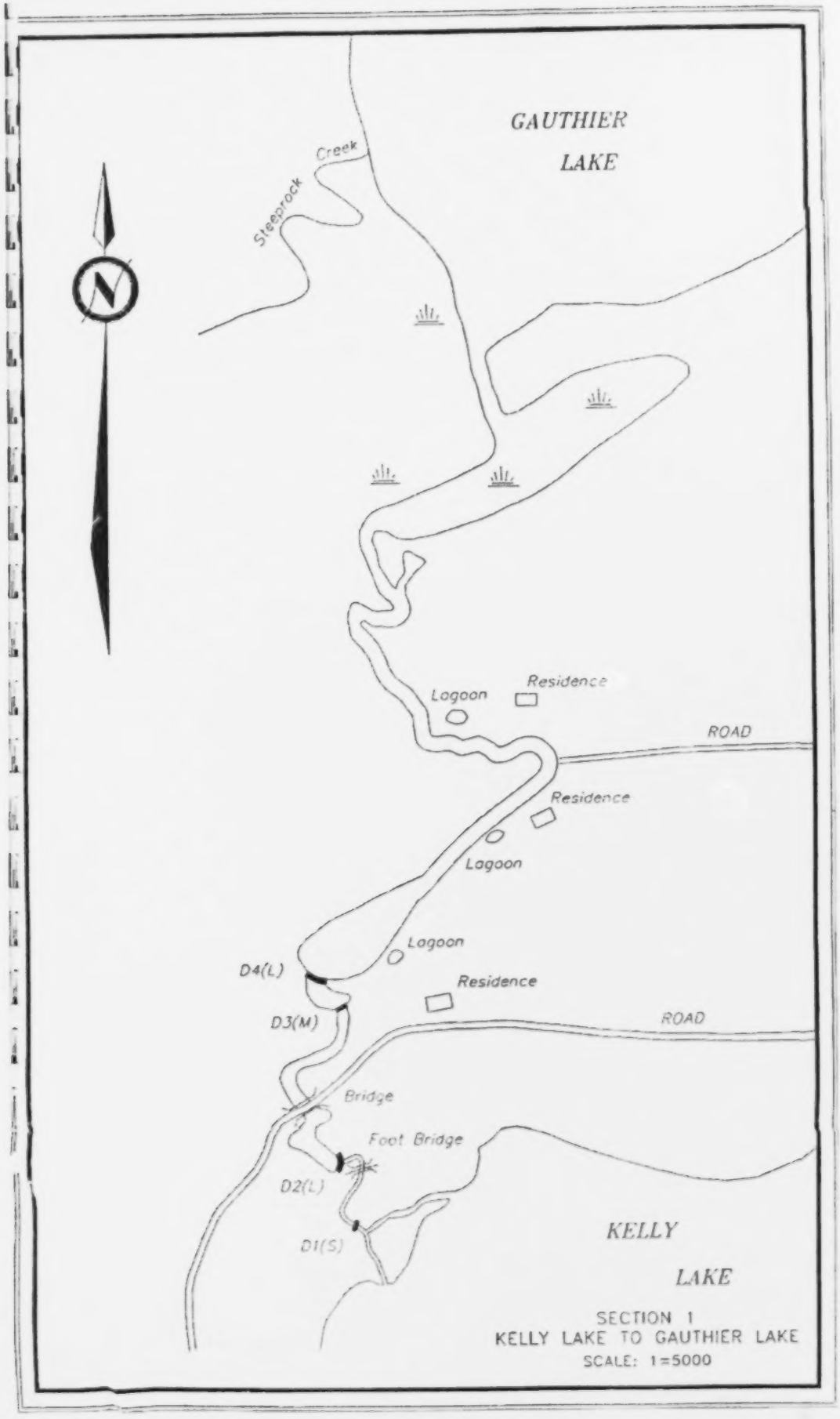
SECTION 5

Supervision	
three days	750.00
travel & accom	300.00
Blaster	
13 dams	700.00
travel & accom	300.00
Labour	
six man/days	900.00
	$ 2,950.00

TOTAL FOR FIVE SECTIONS . . . . . $ 15,935.00

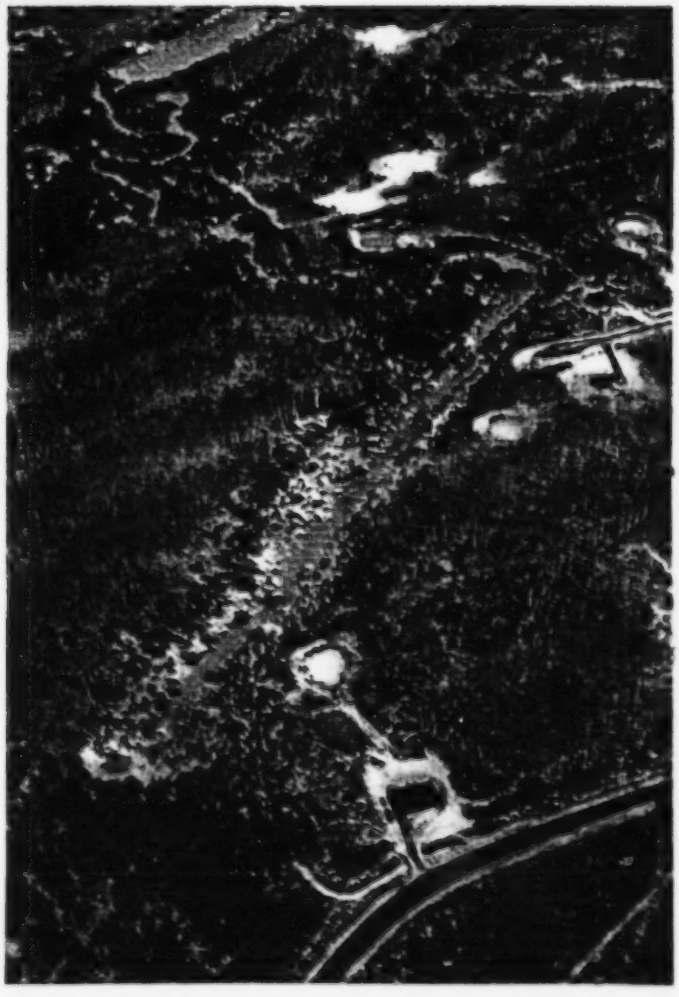
APPENDIX I

SECTION 1
MAP AND PHOTOGRAPHIC RECORD
KELLY LAKE TO GAUTHIER LAKE



SECTION 1
KELLY LAKE TO GAUTHIER LAKE
SCALE: 1=5000

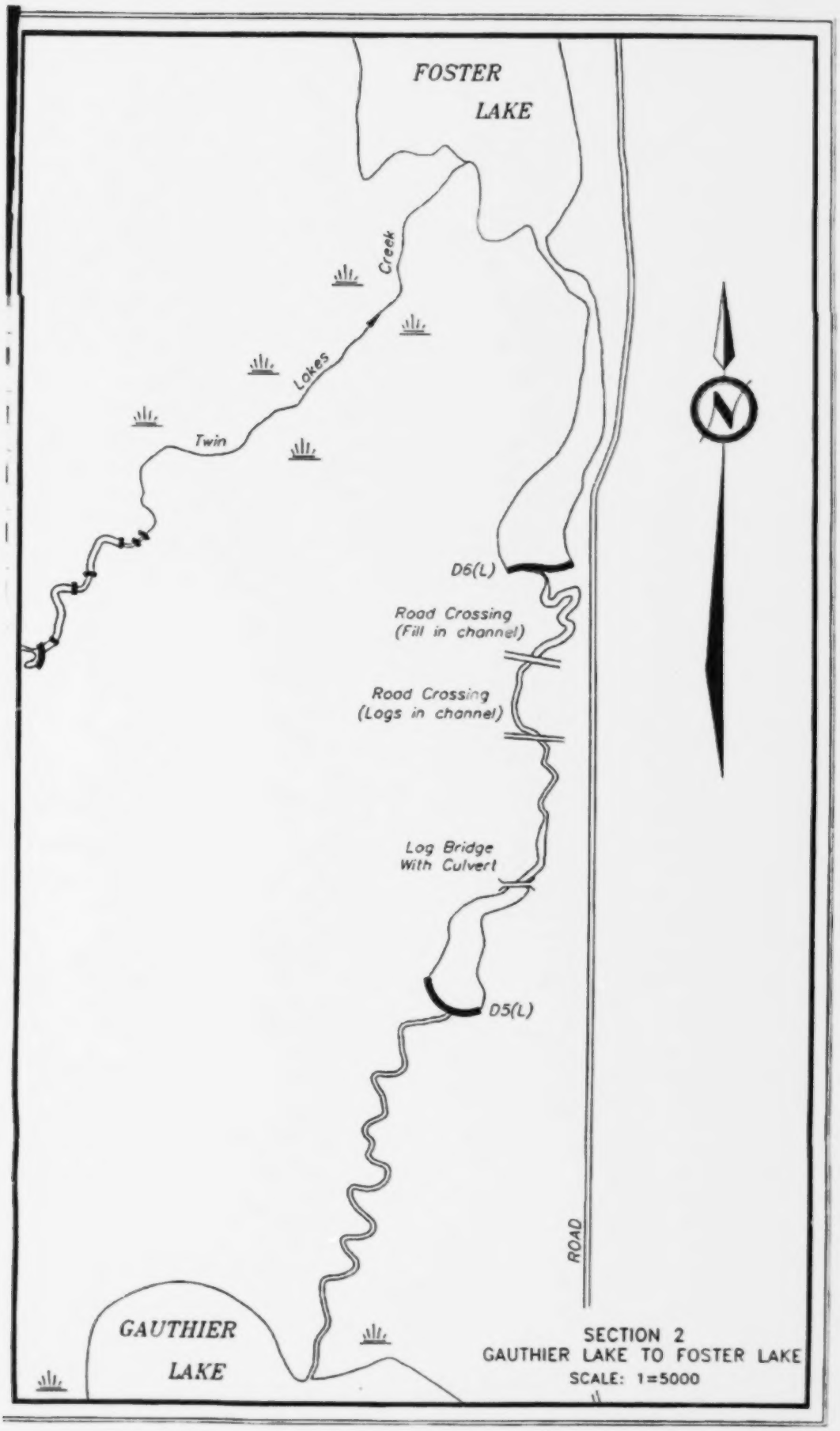
Water backed up by D2 to the main road.



D4 backing up water near 3 lagoons in the Kelly Lake community.

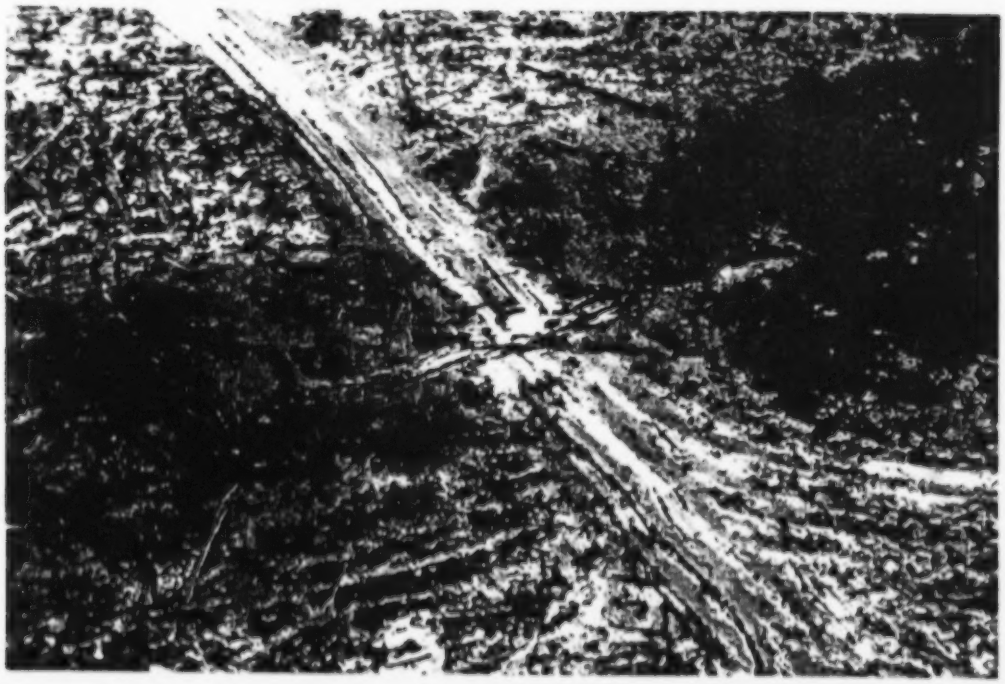
APPENDIX II

SECTION 2
MAP AND PHOTOGRAPHIC RECORD
GAUTHIER LAKE TO FOSTER LAKE


FOSTER
LAKE
Creek
Lakes
Twin
D6(L)
Road Crossing
(Fill in channel)
Road Crossing
(Logs in channel)
Log Bridge
With Culvert
D5(L)
ROAD
GAUTHIER
LAKE
N
SECTION 2
GAUTHIER LAKE TO FOSTER LAKE
SCALE: 1=5000

Gauthier Lake in foreground, Foster Lake behind.

Lower portion of Section 2 as it flows into Gauthier Lake.



Middle road crossing in Section 2, logs pushed into channel.

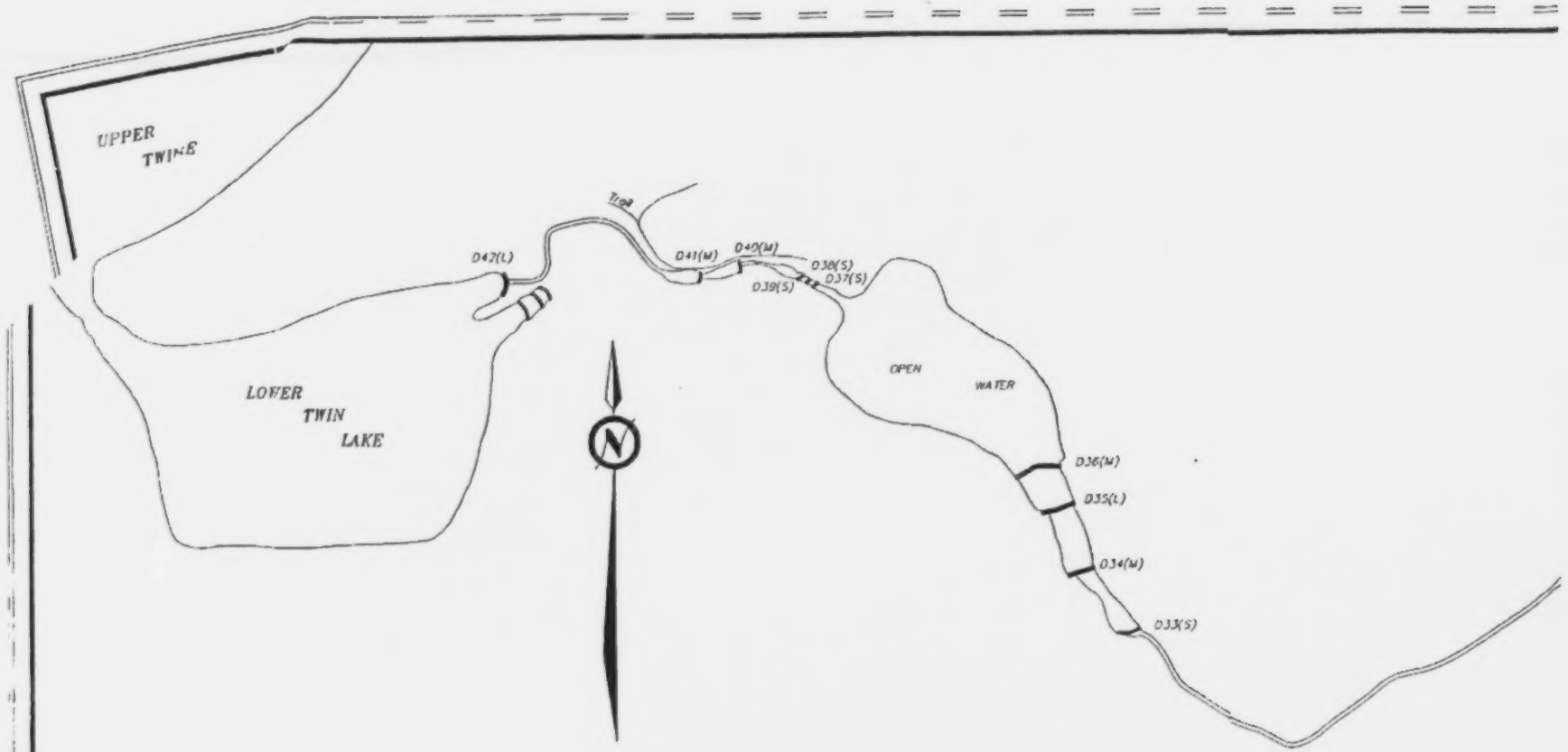
Road crossing below D6, fill has been deposited in channel.

Upper portion of Section 2 and Foster Lake. Outlet is at lower right and inlet from Twin Lakes winds through grasses in lower left.

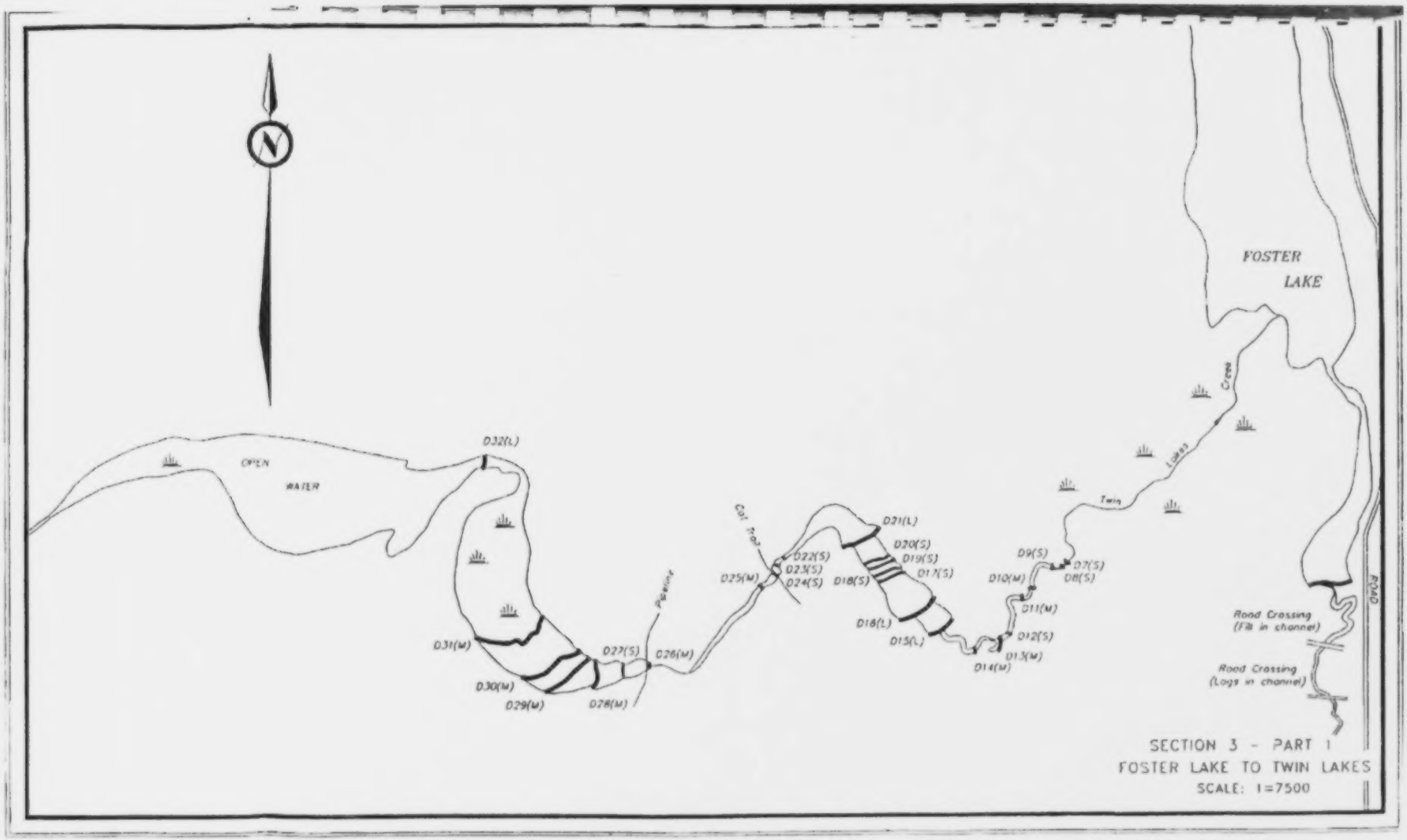
D6, located in above photo to the right of the helicopter skid tip.

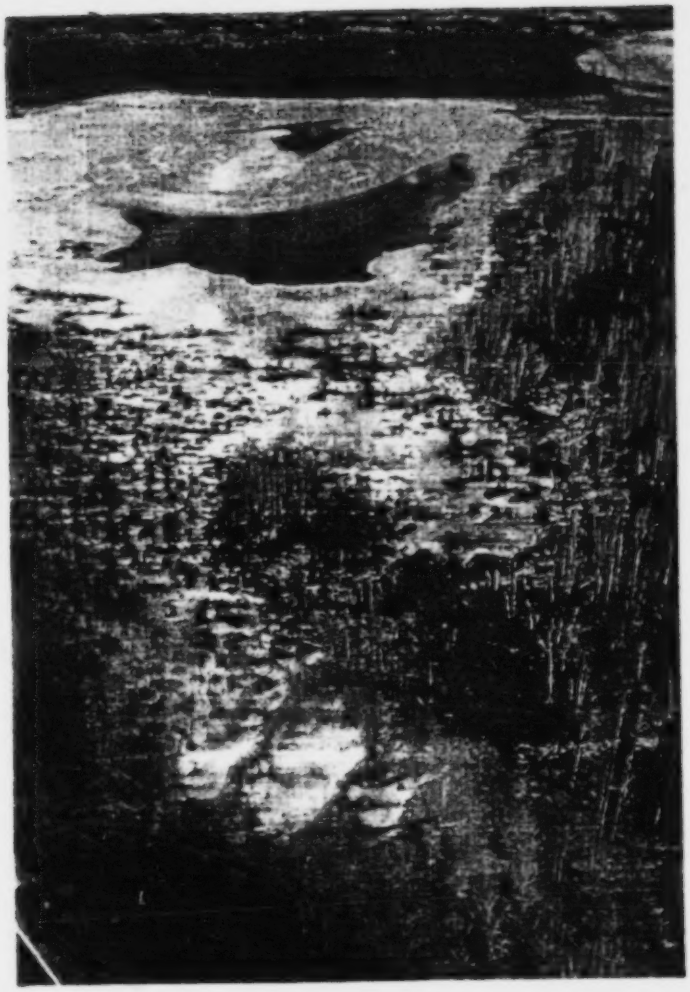
APPENDIX III

SECTION 3
MAP AND PHOTOGRAPHIC RECORD
FOSTER LAKE TO TWIN LAKES



SECTION 3 - PART 2
FOSTER LAKE TO TWIN LAKE
SCALE: 1=7500


N
OPEN
WATER
D32(L)
D31(M)
D30(M)
D29(M)
D28(M)
D27(S)
D26(M)
D25(M)
D24(S)
D23(S)
D22(S)
D21(L)
D20(S)
D19(S)
D18(S)
D17(S)
D18(L)
D15(L)
D14(M)
D13(M)
D12(S)
D11(M)
D10(M)
D9(S)
D8(S)
D7(S)
Portage
Cut Trail
Twin
Lakes
Creek
FOSTER
LAKE
Road Crossing
(Fill in channel)
Road Crossing
(Logs in channel)
ROAD
SECTION 3 - PART 1
FOSTER LAKE TO TWIN LAKES
SCALE: 1=7500



Lower Twin Lake and D42 to the right of photo centre.

Section between Upper and Lower Twin Lakes. There are no beaver dams in this section.

Upper and lower Twin Lakes ii background. Small lake ii. foreground formed by dams 33 through 36.

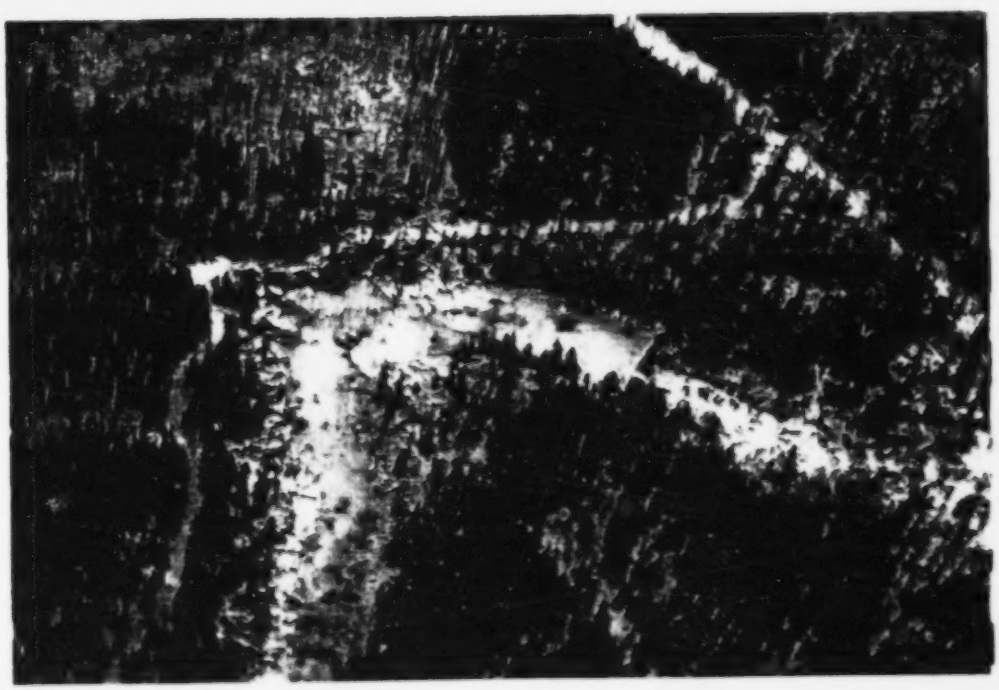
Small lake formed by dams 33 through 36.

Pipeline crossing and dams 26 to 30.

D30 and extensive swamp.

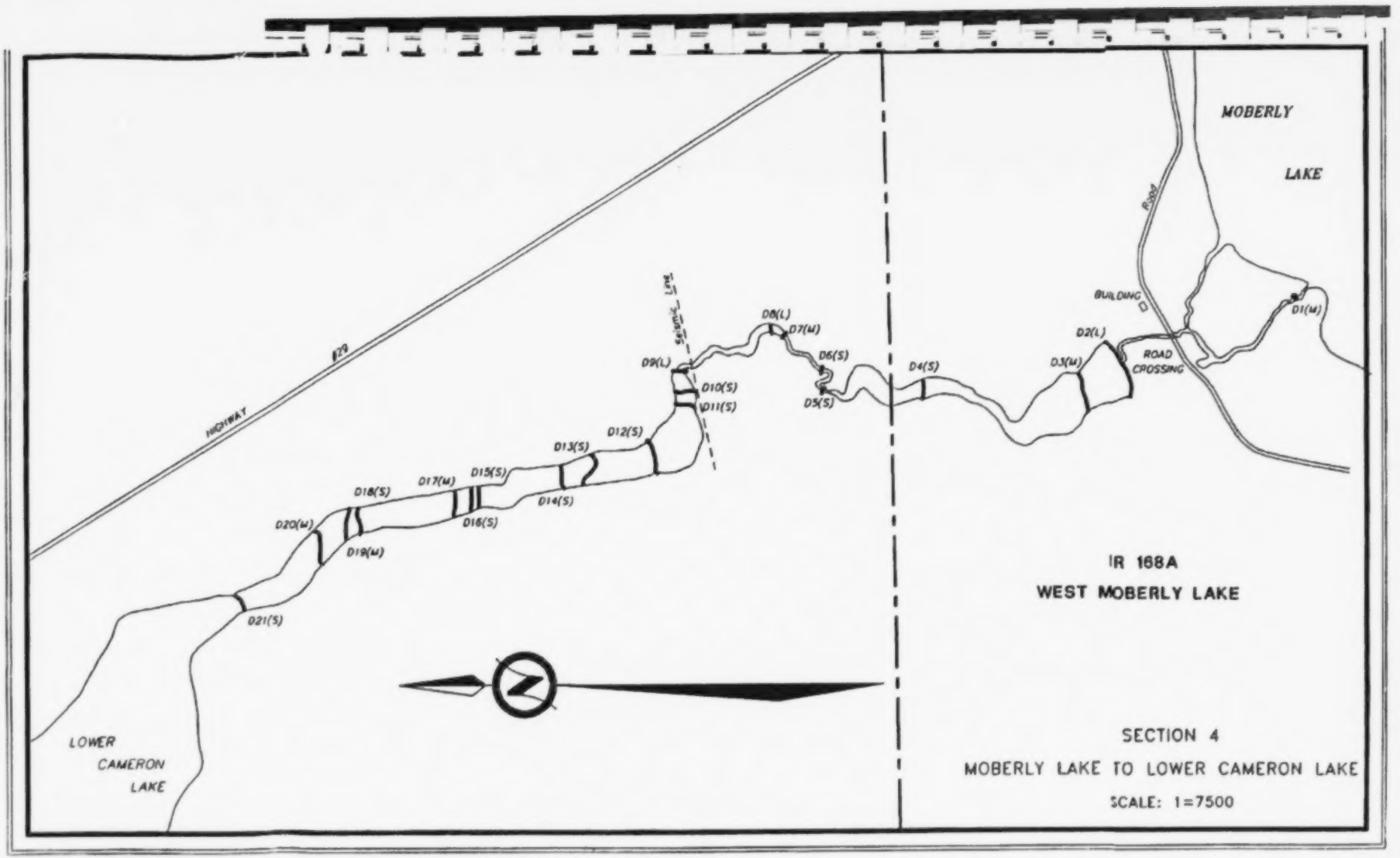
Lower portion of Section 3 as it winds through willows and grasses into Foster Lake.

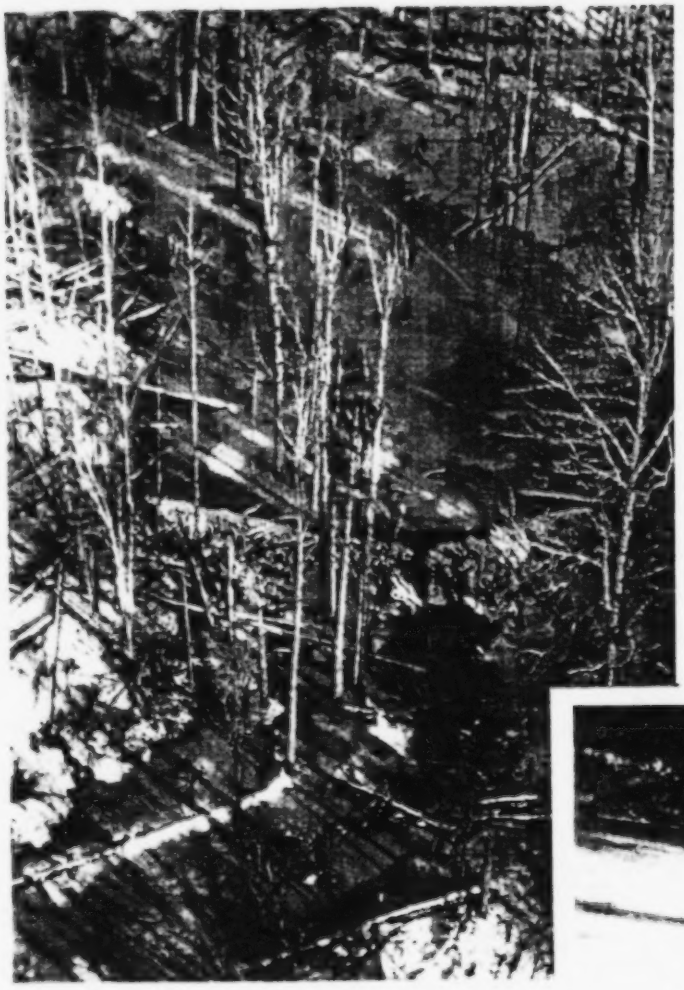
D21 in the lower portion of Section 3.



APPENDIX IV

SECTION 4
MAP AND PHOTOGRAPHIC RECORD
MOBERLY LAKE TO S. CAMERON LAKE


MOBERLY
LAKE
R.504
BUILDING
ROAD
CROSSING
D1(M)
D2(L)
D3(M)
D4(S)
D5(S)
D6(S)
D7(M)
D8(L)
D9(L)
D10(S)
D11(S)
D12(S)
D13(S)
D14(S)
D15(S)
D16(S)
D17(M)
D18(S)
D19(M)
D20(M)
D21(S)
HIGHWAY
879
LOWER
CAMERON
LAKE
IR 168A
WEST MOBERLY LAKE
SECTION 4
MOBERLY LAKE TO LOWER CAMERON LAKE
SCALE: 1=7500

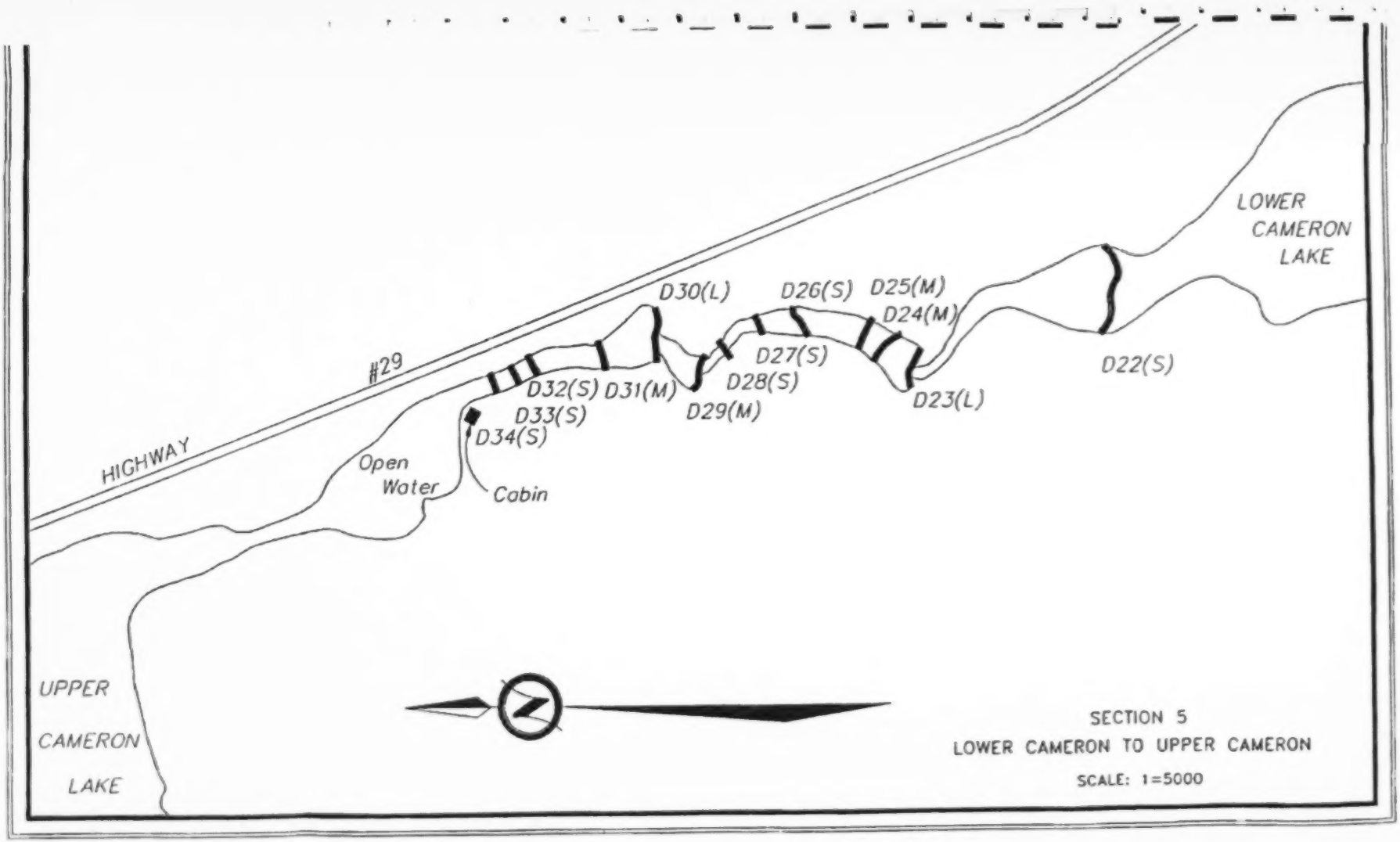


D30

D34, the last dam before North Cameron Lake.

D22 at inlet to South Cameron Lakes.

D25.

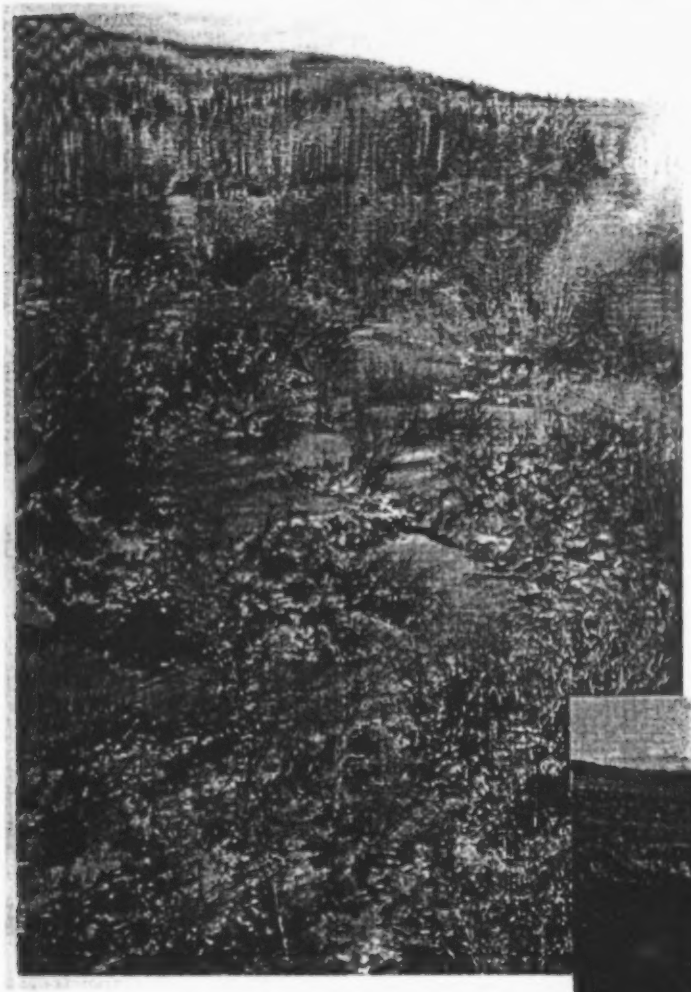

LOWER
CAMERON
LAKE
D30(L)
D26(S)
D25(M)
D24(M)
D27(S)
D22(S)
#29
D32(S)
D31(M)
D28(S)
D33(S)
D29(M)
D23(L)
D34(S)
HIGHWAY
Open
Water
Cabin
UPPER
CAMERON
LAKE
SECTION 5
LOWER CAMERON TO UPPER CAMERON
SCALE: 1=5000

APPENDIX V

SECTION 5
MAP AND PHOTOGRAPHIC RECORD
S. CAMERON LAKE TO N. CAMERON LAKE

South Cameron Lake and outlet. Water is backed up by dams 13 through 21.

Dams 15 through 21 and the outlet of South Cameron Lake.



D1 between Moberly Lake and the road crossing.

Foreground, water backed up by D1 below the road.